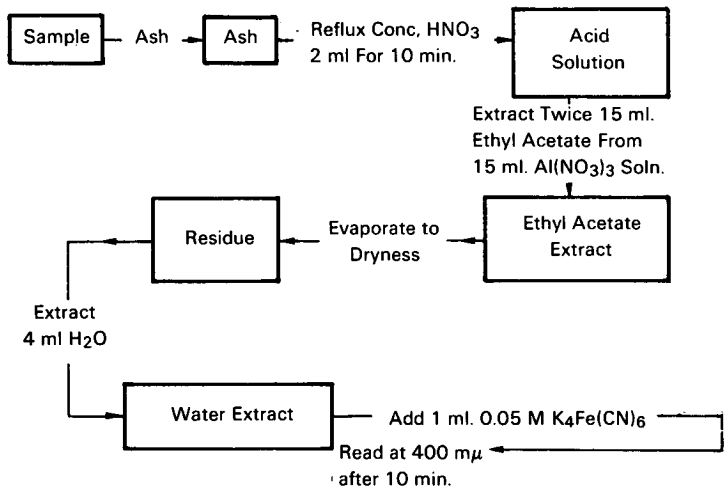
AEC-NASA TECH BRIEF

Simple Colorimetric Method Determines Uranium in Tissue



The problem:

To devise a simple method for the determination of uranium in tissue. Ever since U^{235} has been used for neutron-capture therapy of tumors, a method for its determination in tissues has been needed which is sufficiently simple in practice and equipment for use in hospital laboratories. A number of methods for this analysis now exist, but all require sophisticated, nonstandard equipment.

The solution:

A simple colorimetric micromethod, which uses equipment and reagents that are available in most clinical laboratories. The method can determine concentrations of uranium as low as 10^{-8} mole per 1-gram tissue sample. The method involves dry ashing organic extraction, and colorimetric determination of uranyl ferrocyanide at 400 mμ. As little as 4 micrograms of uranium can be conveniently determined by this technique.

How it's done:

The analytical method developed for determining uranium in tissue is outlined schematically in the figure, and summarized in the following steps:

1. A tissue sample is first ashed in a covered crucible at 700°C for 2 hours, or by means of a hand-held Fisher burner.
2. The sample is cooled and 2 ml of concentrated HNO_3 are added. The material is covered with a watch glass, and refluxed for about 10 minutes on a hot plate.
3. The sample is cooled and washed quantitatively into a 60 ml separatory funnel which contains 15 ml of ethyl acetate and 15 ml of a nearly saturated aqueous solution of $Al(NO_3)_3$. The mixture is agitated and the ethyl acetate layer removed; then it is reextracted with 15 ml of fresh ethyl acetate. The extracts are then combined in a 50-ml beaker and evaporated to dryness on a hot plate; the heat is then applied continuously for another 20 minutes. (continued overleaf)

4. The material is extracted with water, and any insoluble residue is filtered off as the extract is transferred to a cuvette. The volume is increased up to 4.0 ml, and 1.0 ml of 0.05 M $K_4Fe(CN)_6$ is added.
5. The material is mixed, and after 10 minutes is read at 400 mμ.

The sensitivity of the technique can be increased five times by the use of one-fifth the above volumes and a 1.0-ml, 1-cm cuvette.

Notes:

1. On the basis of sample tests made for the recovery of uranium from beef liver (a tissue having many interfering inherent ions), this procedure should be applicable to any tissue.
2. This uranium determination technique could be used in agricultural research, tracer studies, testing of food products, or medical research.
3. Additional details are contained in *Biological and Medical Research Division Annual Report, 1965,* ANL-7136 p. 188–189, 175–178, Argonne National Laboratory, Argonne, Illinois. This report is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151. $3.00 each (microfiche, $0.65).
4. Inquiries concerning this innovation may be directed to:

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Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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